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DEVILS LAKE AREA, NORTH DAKOTA WINTER TEST SITE FOR EQUIPMENT

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U. S. NAVAL CIVIL ENGINEERING LABORATORY
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DEVILS LAKE AREA, NORTH DAKOTA
WINTER TEST SITE FOR EQUIPMENT

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by

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ABSTRACT

During the past 12 years the Laboratory has used various winter sites in the Sierras of California to test the functional performance of polar structures and equipment. Conditions for these tests have been marginal at best. Since 1960 a search has been conducted for a site more suitable for this testing prior to shipment of new and novel equipment to the arctic or antarctic. A primary requirement for the new site was availability of relatively thick shallow-water ice.

An investigation of the Devils Lake area in North Dakota indicates that this area fulfills the current requirements for a Laboratory winter test site. Its winters are dry and cold and the ice on Devils Lake averages 36 inches in January and February. Also, considerable ice is beached and rafted along the shore each winter. Temperatures during these two months range from 0 F to -40 F and the ground is normally covered with 4 to 12 inches of dry, granular snow. The area is accessible by road, rail and air. Good accommodations are available in the town of Devils Lake and support facilities are available at the North Dakota National Guard's Camp Grafton which is located on Devils Lake.

INTRODUCTION

During the past 12 years, the Laboratory has used numerous cold weather test sites on the eastern slopes of the Sierras for testing equipment, and buildings, prior to sending them to remote areas in the arctic or antarctic. While these sites were conveniently located, their elevation and climatology was marginal for most of the Laboratory needs. Squaw Valley was the one outstanding exception because of the unusual application of snow compaction at that location during the 1960 Olympic Winter Games.

Since Squaw Valley, the Laboratory polar research program has been directed principally toward the utilization of ice and snow for roads, runways and skiways in Antarctica. Preliminary evaluation of equipment for this work requires dry snow, ice and prolonged cold periods with temperatures from 0 F to -30 F. None of these are available in the Sierras of California.

This report covers an investigation of the Devils Lake area in North Dakota as a potential winter test site. The site appears well suited for functionally testing new and novel Laboratory equipment developed for polar use. Its winters are very cold and beached and rafted ice is normal along the shore of Devils Lake.

BACKGROUND

The Laboratory Sierra test sites, most of which were located on U. S. Forest Service land, had several drawbacks. To obtain sufficient snowfall and cold weather they were located at altitudes from six to eight thousand feet above sea level. This had a decided affect on the performance of equipment under test because of the loss in engine horsepower. Due to their nearness to the Pacific, snowfall was irratic and its free water content was very high. Temperatures at the test sites were usually below freezing at night but 10 to 20 degrees above freezing in mid-day. In addition, there was considerable solar radiation each day.

Subsequent to 1960 it became increasingly more important that a winter test site with consistantly cold temperatures of long duration be located for the Laboratory. Also, there was a need for a body of water where the winter ice would be of sufficient thickness to functionally test various types of ice equipment. Based on a field investigation in the Yellowstone area of Montana and Idaho in January 1962, a tentative ice covered lake site was selected near Ashton, Idaho and tests on one item of ice construction equipment was scheduled for this site in February 1962. However, chinook winds, unseasonally warm weather and unusual flood conditions caused the test to be aborted at the last minute.

The search for a suitable continental winter test site continued during the spring of 1962. A field investigation was made in the Devils Lake area North Dakota during June 1962. This investigation coupled with a review of its climatology indicated that it was suitable for the Laboratory needs.

LOCATION

Devils Lake, which is a chain of shallow fresh water alkaline lakes, is located just south of the town of Devils Lake, North Dakota (Figure 1). It is about 1470 feet above sea level and 75 miles south of the Canadian border. The surrounding terrain is generally level except for some low wooded hills a few miles south of the lake. Camp Grafton, field headquarters and training area for the North Dakota National Guard, is located on the eastern shore of the principle lake in the Devils Lake chain. The administrative area at Camp Grafton is about 5 miles from the town of Devils Lake.

DESCRIPTION

The terrain along Devils Lake in the Camp Grafton area is relatively flat with a gentle slope to the water's edge. It is covered with grass and an occasional bush or tree (Figure 2).

The water in the lake is quite shallow for some distance out from shore (Figure 3). In winter the lake is completely frozen over. Because of the alkaline content of the water the ice is cloudy in appearance and evidently more ductile than clear fresh water ice. According to local residents the Devils Lake ice is very elastic and breaks up slowly under load unlike normal fresh water ice.

The prevailing winds in the Camp Grafton area are generally from the west. This condition usually drives a considerable quantity of ice ashore each winter. The normal ice thickness in the lake is 36 inches or more by late January and the shore ice, which is rafted as it is driven inland, is much thicker.

CLIMATOLOGY

The climate in the Devils Lake area is characterized by marked seasonal changes with 50 percent of the annual percipitation (17.25 inches) occurring in June, July and August. The winters are cold and dry with an annual average snowfall of 35 inches. This snow, in the form of small dry flakes and crystals, occurs mostly between early November and early April. Snow depths in January and February range from 4 to 12 inches depending on the snowfall.

Considerable below 0 F weather occurs in a normal winter, -10 to -31 F being quite common with occasional lows in the minus forties. In January and February very few days reach 0 F or above and high winds are uncommon during these two months. The local topography has little influence on the local weather.

The U. S. Department of Commerce has a well equipped weather station in the town of Devils Lake under Mr. Earl Hoffman, Supervising Meteorologist. Climatological data for the area is available as far back as 1904.

SUPPORT

Transportation, accommodations and facilities are adequate for Laboratory winter tests at Devils Lake.

Devils Lake, North Dakota

The town of Devils Lake, North Dakota is located in the Northeastern part of the state on U. S. Highway 2. It is a modern farming and resort community with good hotel, motel and restaurant accommodations. Devils Lake is served by the Great Northern and Soo Line Railroads. Daily flights to and from Minneapolis, Minnesota, 400 miles to the South east are provided by the North Central Airlines.

Camp Grafton, North Dakota

Camp Grafton, which is the field headquarters for the North Dakota National Guard, is located on federal land. It is entirely fenced and has a number of permanent warehouses and an excellent heavy equipment repair shop (Figure 4).

The greatest activity at Camp Grafton occurs during the first two weeks in June when the Guard holds its annual maneuvers. During the balance of the year it is occupied by a camp maintenance group, made up of 35 guardsmen presently under the supervision of Major V. J. McWilliams. Warrant Officer Allen Tabor is the camp foreman. During the winter, this group maintains, repairs and overhauls all types of equipment ranging from jeeps to large tanks.

The camp is serviced by the Fort Totten station on a branch line of the Great Northern Railroad. This station which is located on a siding in the camp near the main gate, is equipped with a platform for loading and unloading heavy equipment (Figure 5). Equipment can be moved from this platform to any area within the camp under its own power or, if necessary, by truck.

General Headquarters for the North Dakota National Guard is located at Fraine Barracks, Bismark, North Dakota. Currently the Adjutant General for the Guard is General Melhouse. Potential Laboratory use of the Camp Grafton facilities were arranged with the Adjutant General's office in July 1962. It was agreed that small scale tests could be conducted during the winter months by prior arrangement with the Adjutant General's office. These arrangements were to include a formal request to conduct specific tests at Camp Grafton and the extent of support required for shop facilities and transportation of the test equipment in Camp Grafton. It was also agreed that the Laboratory would provide its own test personnel and that assistance of the Camp Grafton personnel would be requested only in case of an emergency.

Transportation

Vehicles for transportation of Laboratory personnel between Devils Lake, North Dakota and the test site at Camp Grafton can be secured from the General Services Administration Motor Pool at Bismark, North Dakota. This pool is well equipped with sedans and station wagons which can be obtained by the day or month at reasonable rates. Contact with this pool in June 1962 indicated that request for vehicles should be made well in advance especially for long-term requirements.

SUMMARY

The Devils Lake area appears suitable for preliminary performance tests on Laboratory polar equipment during the months of January and February because of:

1. Its continuous dry, cold conditions with normal temperatures of 0 F to -40 F.

2. The availability of ice averaging 36 inches thick on the beach or over shallow water in the Camp Grafton section of Devils Lake.

3. The availability of dry, granular snow fields upto 12 inches thick can be easily moved to form 24 inch or deeper test pads.

4. Its accessibility and the availability of good accommodations in Devils Lake, North Dakota and excellent support facilities at Camp Grafton.

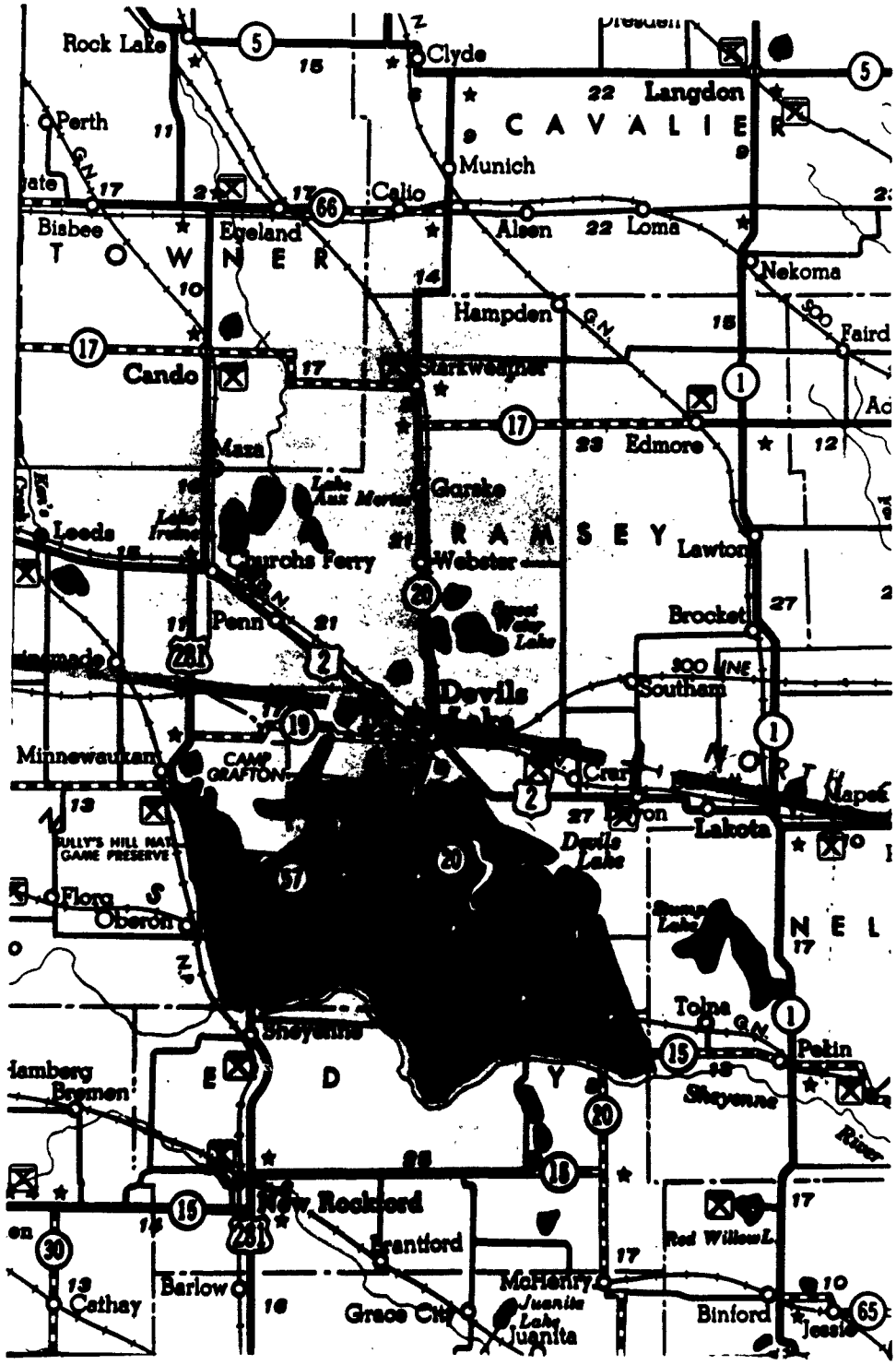

Figure 1. Map of Devils Lake area, North Dakota

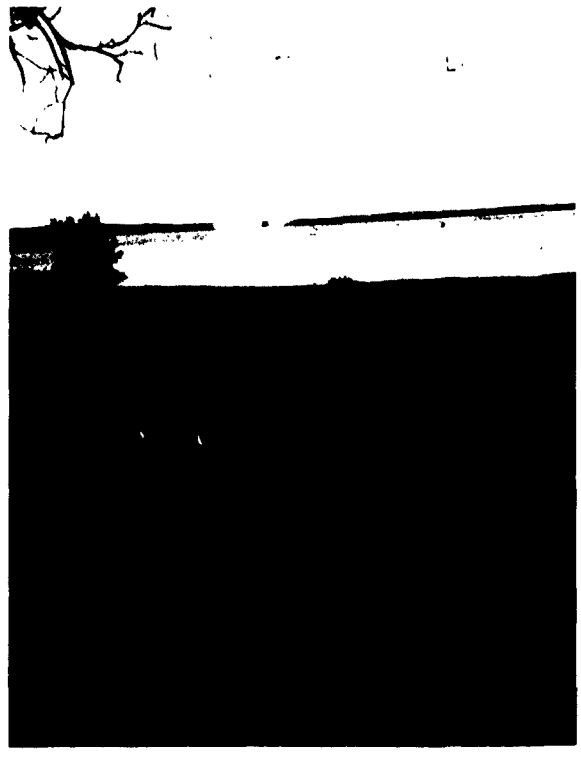

Figure 2. (1825 4/63) Eastern shore of Devils Lake in the Camp Grafton area.

Figure 3. (1824 4/63) Shallow bay on eastern shore of Devils Lake.

Figure 4. (1827 4/63) Heavy equipment repair shop at Camp Grafton.

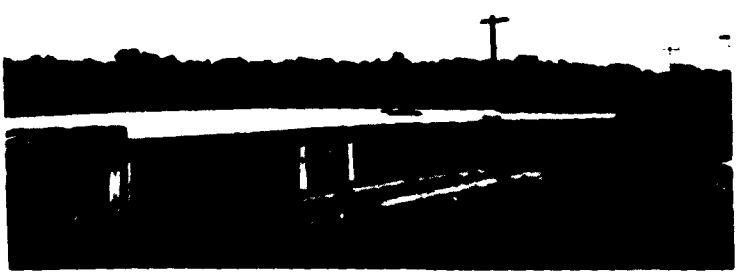

Figure 5. (1826 4/63) Railroad unloading platform at Camp Grafton.